CHAPTER 4
DESIGN STANDARDS

Design policy and criteria for state highway improvement projects are provided in the WSDOT Design Manual (latest revision at the time of this plan was dated September 2002). The Design Manual supplements the engineering analyses and judgment that must be applied to state highway projects and provides uniform procedures for documenting and implementing design decisions. When proposed designs meet the requirements contained in the Design Manual, little additional documentation is required. However, it is understood that there is a need for flexibility to adapt the design criteria in the Design Manual for particular situations. In these cases, when critical dimensions of a proposed design do not meet Design Manual criteria, additional documentation is required to record the decision-making process.

This chapter of the SR 99 North Route Development Plan will identify the Design Manual criteria for the critical design elements on this corridor as well as the specific elements that are not appropriate for the long-term plan for this corridor because of its urban, highly developed nature.

As a National Highway System (NHS) route, any improvements would need to be consistent with the full design level contained in Chapter 440 of the Design Manual or would require either approval of this Route Development Plan or a project level design deviation from the WSDOT Design Office. Chapter 440 of the Design Manual provides geometric design criteria based on the functional classification (principal arterial in this case), the type of access control (managed), and the setting (urban).

Based on these criteria, the design classification of P-2 is the closest match for the section from the Battery Street Tunnel to N. 72nd Street and the design classification of P-6 is the closest match for the undivided section from N. 72nd Street to N. 145th Street. However, the design speed for the P-2 classification is 70 mph and the design speed for the P-6 classification is 60 mph. Since the design criteria for these classifications were developed for higher design speeds than are appropriate for this corridor, this Route Development Plan will establish criteria appropriate for the future development of the corridor.

The design criteria for the P-2 and P-6 urban principal arterials are shown in Table 4-1.

Table 4-1
Design Standards for Urban State Highways

Roadway Design Characteristic	Minimum Design Standard for Classification	
	P-2	P-6
Design Hourly Volume:	701 vehicles per hour	701 vehicles per hour
Access Control:	Partial	In Special Cases
Separate Cross Traffic:	Where Justified	Where Justified
Number of Traffic Lanes:	4 or 6	4 or 6
Lane Width:	12 feet	11 feet
Left Shoulder Width:	Variable	8 feet
Right Shoulder Width:	10 feet	8 feet
Median Width:	16 feet (4 lane) or 22 feet (6 lanes)	2 feet
Parking Lanes:	None	10 feet – no parking if over 15,000 ADT
Pavement Type:	High	High or Intermediate
Right of Way Width:	Width necessary for design elements	80 feet
Structure Width:	Full roadway width	Full roadway width

Design Elements

Lane Widths

The existing lane widths for the SR 99 North corridor are listed in Table 1-2. A majority of existing lanes do not meet the current design standards of 12 feet or 11 feet for P-2 and P-6 roadways, respectively. The proposed lane widths with redevelopment are shown in Chapter 6, Long-Term Improvements. Not all of the proposed lane widths will meet the Design Manual criteria and will require design deviations or the approval of this Route Development Plan. These lane widths were agreed upon to improve traffic safety and mobility without significantly impacting neighboring properties.

Horizontal and Vertical Alignment

Stopping Sight Distance

The horizontal sight distance on the SR 99 North was evaluated at the horizontal curve locations in the corridor. Some sections of roadway near curves have sight distance limitations caused by roadside objects obstructing the ability of drivers to see around

corners. Table 4-2 details the beginning and ending mileposts of the horizontal curves, the design speed of the roadway in the area, the available sight distance and corresponding speed to allow stopping, and the obstruction(s) that limits sight distance. Sight distance is checked by measuring the longest line of sight that allows a driver to see an object 0.5 foot tall in the middle of the lane. The corresponding speed is the speed that a driver could be traveling at and still come to a safe stop after seeing the object in the road.

Table 4-2
Sight Distance on the SR 99 North Study Corridor

Horizontal Curve Location	Design Speed (MPH)	Available Sight Distance and Corresponding Speed		Obstruction(s)
		Northbound	Southbound	
MP 33.60 – MP 33.69	45	~250 ft (~35 mph)	~250 ft (~35 mph)	Median barrier and side slope/vegetation
MP 33.83 – MP 34.06	45	Meets Standard	Meets Standard	None
MP 34.11 – MP 34.24	45	Meets Standard	Meets Standard	None
MP 36.30 – MP 36.45	45	Meets Standard	Meets Standard	None
MP 36.45 – MP 36.51	45	Meets Standard	~275 ft (~37 mph)	Median barrier
MP 36.51 – MP 36.58	45	~215 ft(~32 mph)	~305 ft (~40 mph)	Median barrier and vegetation
MP 36.72 – MP 36.80	30	Meets Standard	Meets Standard	None
MP 36.80 – MP 36.85	30	~155 ft (<25 mph)	Meets Standard	Median barrier and structures

Sections of the corridor with limited sight distance would require substantial changes to the roadway's geometrics and alignment in order to meet WSDOT's design standards. Due to the built up environment of the corridor, these changes would require substantial impact to the adjacent land uses. Recognizing the built up nature of the corridor, limited sight distance improvements for corridor users can be provided by trimming vegetation limiting visibility of the roadway and providing additional law enforcement of posted speed limits.

Although median barriers can reduce a user's ability to see small items on the roadway surface, median barriers allow clear visibility of stopped vehicles and other taller objects and are recommended to remain in place along the SR 99 North Corridor.

No vertical alignment information was available at the time of this study; therefore the vertical stopping sight distance was not checked. An approved deviation would be required for any vertical curve not meeting the stopping sight distance standard at the time of construction of future projects.

Superelevation

No superelevation data were available at the time of this study. However, based on field visits, the existence of reverse curves in the alignment, and the location of the catch basins along the outside curb line, SR 99 North has a normal crown roadway section throughout the corridor. The adequacy of the superelevation could not be evaluated because the exact super elevation rate was not known, but it is likely that some of the curves would not meet the Design Manual criteria for existing curve superelevations. Any future project in the area of the horizontal curves would need to evaluate the existing superelevation and obtain a deviation for any curve not having the standard superelevation.

Compound Curves

A compound curve is the result of joining two simple curves in the same direction. Chapter 620 of the WSDOT Design Manual states that when compound curves are used; make the shorter radius two-thirds (1.5:1 ratio) of the longer radius. It also states that to make the total arc length of a compound curve not less than 500 feet. These criteria are intended to reduce the risk of an entering vehicle traveling too fast for a smaller curve directly after a larger curve.

The curves on SR 99 North near Green Lake are compound and have a 1.8:1 ratio. This does not meet the design criteria; however, it is unlikely that changes would be made because of the impact to Green Lake Park and adjacent properties.

Design Deviations and Context Sensitive Design

Design Deviations

WSDOT guidelines dictate that roadway characteristics (such as lane, median, and shoulder widths) that do not meet design standards should be upgraded so that they do meet standards. However, in certain situations, it may not be possible to perform these upgrades. For example, widening traffic lanes to design standards might be precluded by existing development or environmental constraints. Where it is not possible or practical to upgrade roadway elements to design standards, a Design Deviation approved by the WSDOT Headquarters will be required.

The SR 99 North corridor was originally constructed in the 1920s and 1930s. Over the past 70 plus years, land adjacent to the highway has been significantly built up with some residential and a variety of commercial land uses—some of the buildings date

back to the original highway construction and before. It will not be practical to upgrade some of the design elements to meet the design criteria shown in Table 4-1 without significant impact to the properties and environment because of the constraints of the existing land use and development.

This Route Development Plan's long-term improvement recommendations for future roadway design have taken into account the corridor's existing conditions and in some cases recommend design improvements that do not meet current design standards. Please see Chapter 6: Long-Term Improvements, for a description of proposed improvements.

As a result of this study, long-term cross-sections have been developed for most of this corridor. Since some elements of the proposed cross sections (i.e. lane and shoulder widths) do not meet the design criteria identified in the WSDOT Design Manual, the approval of this RDP is required or a project level design deviation. Once the SR 99 North RDP is approved, any proposed deviations that are not addressed in this RDP would have to be documented at the time the project is developed and would require WSDOT approval of the design deviation.

Context Sensitive Design

As described in the Introduction, Context Sensitive Design (CSD) is an approach to transportation planning that considers the needs of the users, the neighboring communities, and the environment (both built and natural). It integrates projects into the context or setting in a sensitive manner through careful planning, consideration of different perspectives, and tailoring designs to particular project circumstances.

Many of the RDP's recommendations and especially recommended design deviations are a direct result of the input received from the public through neighborhood plan recommendations, over 50 meetings with community organizations and businesses along the corridor, six Stakeholder Advisory Committee meetings, and two open houses (see Chapter 7: Public Outreach).